Notice No.6

Rules and Regulations for the Classification of Ships, July 2017

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: June 2018

Amendments to	Effective date	IACS/IMO implementation (if applicable)
Part 1, Chapter 2, Sections 2 & 3	Corrigendum	N/A
Part 1, Chapter 3, Sections 4, 5 & 17	Corrigenda	N/A
Part 3, Chapter 4, Section 6	Corrigendum	N/A
Part 3, Chapter 11, Sections 2 & 4	Corrigendum	N/A
Part 3, Chapter 12, Section 2	Corrigendum	N/A
Part 3, Chapter 13, Sections 2 & 7	Corrigenda	N/A
Part 3, Chapter 14, Sections 1, 7 & 8	Corrigenda	N/A
Part 4, Chapter 2, Section 4	Corrigenda	N/A
Part 4, Chapter 8, Section 16	Corrigenda	N/A
Part 4, Chapter 12, Section 1	Corrigenda	N/A
Part 5, Chapter 6, Section 3	Corrigenda	N/A
Part 5, Chapter 8, Section 2	Corrigenda	N/A
Part 5, Chapter 12, Section 1	Corrigenda	N/A
Part 5, Chapter 14, Sections 4, 8 & 9	Corrigenda	N/A
Part 5, Chapter 24, Section 7	Corrigenda	N/A
Part 6, Chapter 2, Sections 1, 3, 14 & 18	Corrigenda	N/A
Part 7, Chapter 11, Sections 2 & 3	Corrigenda	N/A
Part 7, Chapter 12, Section 4	Corrigendum	N/A

Lloyd's Register

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Part 1, Chapter 2
Classification Regulations

■ *Section 2*
Character of classification and class notations

2.9 Application notes

2.9.3 **Manufacturer's certificate** for assignment of the **MCH** notation. Acceptance of the manufacturer's certificate for propelling and essential auxiliary machinery is subject to the following:

(f) The machinery and equipment is manufactured under a recognised quality control system in accordance with the requirements of ~~LR's *Rules for the Manufacture, Testing and Certification of Materials, July 2017, incorporating Notice No. 1 & 2*~~ *Pt 5, Ch 1, 1.3 Alternative approach for product assurance*.

■ *Section 3*
Surveys - General

3.5 Existing ships – Periodical Surveys

3.5.6 The date of the last ~~examination in~~ Bottom Survey ~~or on a slipway~~ will be recorded on the Class Direct website.

Part 1, Chapter 3
Periodical Survey Regulations

■ *Section 4*
Bottom Surveys – In Dry-Dock and In-Water - Hull and machinery requirements

4.3 In-Water Surveys

4.3.4 When there is no access, special consideration shall be given to ascertaining rudder bearing clearances and sternbush clearances of water lubricated bearings based on a review of the operating history, on board testing and stern bearing ~~oil analysis~~ condition data. These considerations are to be included in the proposals for In-Water Surveys which are to be submitted in advance of the survey being required, so that satisfactory arrangements can be agreed with LR.

■ *Section 5*
Special Survey - General - Hull requirements

5.6 Thickness measurement

Table 3.5.3 Minimum requirements for thickness measurements - General

Special Survey I (Ships 5 years old)	**Special Survey III (Ships 15 years old)**	**Special Survey IV and subsequent (Ships 20 years old and over)**
	(3) ~~All transverse webs with associated plating and longitudinals,~~ Internals and the transverse bulkhead complete in the fore peak tank and aft peak tank. *See* Note 6.	(7) ~~All transverse webs with associated plating and longitudinals,~~ Internals and the transverse bulkhead complete in the fore peak tank and aft peak tank. *See* Note 6.

■ *Section 17*
Screwshafts, tube shafts and propellers

17.2 Definitions

17.2.4 **Oil sample examination**. An oil sample examination is a visual examination of the ~~stern tube~~ sterntube lubricating oil taken in the presence of a Surveyor, with a focus on water contamination.

All instances of stern tube have been replaced with sterntube throughout this Ruleset.

Part 3, Chapter 4
Longitudinal Strength

■ *Section 6*
Hull shear strength

6.2 General

6.2.2 Shear flow calculation procedures are generally to be in accordance with *ShipRight Procedure ~~Additional Calculation Procedures for Container Ships~~ Additional calculation procedures for longitudinal strength, July 2016*.

Part 3, Chapter 11
Closing Arrangements for Shell, Deck and Bulkheads

■ *Section 2*
Steel hatch covers

2.5 Local net plate thickness

2.5.1 The local net plate thickness, t, in mm, of the hatch cover top plating is not to be less than:

$$\cancel{t = F_p 15{,}8 s \sqrt{\frac{P}{0{,}95\sigma_o}}} \qquad t = F_p 0{,}0158 s \sqrt{\frac{P}{0{,}95\sigma_o}}$$

■ *Section 4*
Hatch cover securing arrangements and tarpaulins

4.2 Steel covers – Clamped and gasketed

Table 11.4.1 Permissible nominal surface pressure p_n

Support material	P_n in nm/mm^2 when loaded by	
	Vertical force	Horizontal force (on stoppers)
~~Plastics materials on steel~~ Lower friction materials	50	–

Part 3, Chapter 12
Ventilators, Air Pipes and Discharges

■ *Section 2*
Ventilators

2.3 Closing appliances

2.3.6 Mushroom ventilators with a fixed head and closed by a screw down plate (screw down cover) may be accepted in exposed positions within the forward 0,25L_L, excluding those described in *~~Pt 3, Ch 12, 2.3 Closing appliances 2.3.6~~ Pt 3, Ch 12, 2.1 General 2.1.1*, up to a diameter of 750 mm.

Part 3, Chapter 13
Ship Control Systems

■ *Section 2*
Rudders

2.6 Rudder force

2.6.1 The lateral rudder force at the centre of pressure is to be determined for both ahead and astern conditions as follows:

C_R = $\cancel{132\, K^1\, K^2\, K^3\, A\, V^2\, N}$ $132\, K_1\, K_2\, K_3\, AV^2$ N

2.15 Cone couplings with special arrangements for mounting and dismounting the couplings

2.15.6 In case of hydraulic pressure connections the required push-up force P_e, for the cone may be determined by the following formula:

$$\cancel{P_e = P_{reg} d_m \Pi \int \left(\frac{\theta_t}{2} + 0{,}02\right) N} \qquad P_e = P_{req} d_m \Pi \int \left(\frac{c}{2} + 0{,}02\right) N$$

2.17 Bearings

Table 13.2.13 Bearings

Item	Requirement
(5) Main bearing housing wall thickness, *see* Note 5	Greater than $0{,}2d_c$

■ *Section 7*
Equipment

7.1 General

7.1.9 All anchors and chain cables are to be tested at establishments and on machines recognised by the Committee and under the supervision of LR's Surveyors or other Officers recognised by the Committee, and in accordance with *Ch 10 Equipment for Mooring and Anchoring* of the Rules for Materials.

7.1.10 Test certificates showing particulars of weights of anchors, or size and weight of cable and of the test loads are applied to be furnished. These certificates are to be examined by the Surveyors when the anchors and cables are placed on board the ship.

7.1.11 Steel wire and fibre ropes are to be tested as required by *Ch 10 Equipment for Mooring and Anchoring* of the Rules for Materials.

Part 3, Chapter 14
Cargo Securing Arrangements

■ *Section 1*
General

1.6 Symbols and definitions

1.6.1 The following definitions are applicable to this Chapter, except where otherwise stated:

If φ is less than φ_m:

$$\cancel{\varphi_f = 55 f_{am} f_V f_{BK} e^{(-0{,}25B)}} \qquad \varphi_f = 55 f_{gm} f_V f_{BK} e^{(-0{,}25B)}$$

■ *Section 7*
Container securing arrangements for stowage using cell guides

7.3 Carriage of 20ft containers in 40ft cell guides in holds

7.3.3 Where it is desired to stow 20 ft containers without external support at the mid-bay location with or without 40 ft overstow, so-called 'mixed stowage' arrangements meeting the following requirements are applicable:

(a) Maximum homogeneous container weights for 20 ft containers stowed in cell guides with no 40 ft container overstowed can be derived from ~~*Table 14.7.2 Maximum containers weights, W_h of 20 ft containers stowed in 40 ft cell guides with overstow, diagonal stacking cone arrangement*~~ *Table 14.7.1 Maximum container weight of Wh 20 ft containers stowed in 40 ft cell guides with no overstow*, depending on the transverse acceleration and the number of tiers in the stack.

(c) All inhold mixed stowage tables have been derived on the basis of all 20 ft containers having the same weight. However it is acceptable to carry non-homogeneous stacks provided the following two conditions are met:

(ii) The total moment of 20 ft containers in a stacks about the base is not to be greater than the moment exerted by an equivalent homogeneous stack of weight W_h, i.e.

$$\cancel{\sum_{i=2}^{N}(W_i \cdot c_i(i-1)) \leq (N-1) \cdot W_h \cdot \frac{c_a \cdot N}{2}}$$

$$\sum_{i=2}^{N}(W_i \cdot c_a(i-1)) \leq (N-1) \cdot W_h \cdot \frac{c_a \cdot N}{2}$$

where:

W_i weight of container *i*.

~~c_i height of container *i*.~~

W_h is the homogeneous container weight as determined from *Table 14.7.1 Maximum container weights of W_h 20 ft containers stowed in 40 ft cell guides with no overstow, Table 14.7.2 Maximum containers weights, W_h of 20 ft containers stowed in 40 ft cell guides with overstow, diagonal stacking cone arrangement or Table 14.7.3 Maximum container weights W_h of 20 ft containers stowed in 40 ft cell guides with overstow, other stacking cone arrangement* as applicable. Where W_h is corrected by Note 5 of the tables, W_h is to be taken as W_{hc}.

c_a average height of the 20 ft containers in the stack.

N Number of 20 ft containers.

Table 14.7.1 Maximum containers weights, W_h of 20 ft containers stowed in 40 ft cell guides with no overstow

Lowest tier transverse acceleration ($= {}^{a_y}/_{g}$) *see Pt 3, Ch 14, 8.2 Ship motion, wind and green sea forces acting on containers 8.2.5*	Maximum homogeneous container weights in tonnes (number of 20 ft containers)									
	3 tiers	4 tiers	5 tiers	6 tiers	7 tiers	8 tiers	9 tiers	10 tiers	11 tiers	12 tiers
Note 5. ~~For mixed box height stowage, the weight is to be reduced as follows:~~ ~~$W_h = W_h \frac{2.438}{c_a}$~~ ~~Where:~~ ~~$c_a$ is the average height of the 20 ft containers~~ Where the homogeneous container weight (W_h) derived from the table is lower than the rated weight of the container, the maximum homogeneous weight is to be corrected to account for the height of the containers used, as follows: $W_{hc} = W_h w_{ac}$ Where: $w_{ac} = \frac{2.591}{c_a}$ which is not to be taken greater than 1 c_a is the average height of the 20 ft containers										

Table 14.7.2 Maximum containers weights, W_h of 20 ft containers stowed in 40 ft cell guides with overstow, diagonal stacking cone arrangement

Lowest tier transverse acceleration ($= {}^{a_y}/_{g}$) *see Pt 3, Ch 14, 8.2 Ship motion, wind and green sea forces acting on containers 8.2.5*	Maximum homogeneous container weights, in tonnes (number of 20 ft containers)							
	4 tiers and fewer	5 tiers	6 tiers	7 tiers	8 tiers	9 tiers	10 tiers	11 tiers
Note 5. ~~For mixed box height stowage, the weight is to be reduced as follows:~~ ~~$W_h = W_h \frac{2.438}{c_a}$~~ ~~Where:~~ ~~$c_a$ is the average height of the 20 ft containers~~ Where the homogeneous container weight (W_h) derived from the table is lower than the rated weight of the container, the maximum homogeneous weight is to be corrected to account for the height of the containers used, as follows: $W_{hc} = W_h w_{ac}$ Where: $w_{ac} = \frac{2.591}{c_a}$ which is not to be taken greater than 1 c_a is the average height of the 20 ft containers								

Table 14.7.3 Maximum containers weights, W_h of 20 ft containers stowed in 40 ft cell guides with overstow, other stacking cone arrangement

Lowest tier transverse acceleration $(= {}^{a_y}/_{g})$ *see Pt 3, Ch 14, 8.2 Ship motion, wind and green sea forces acting on containers 8.2.5*	Maximum homogeneous container weights, in tonnes (number of 20 ft containers)					
	3 tiers	4 tiers	5 tiers	6 tiers	7 tiers	8 tiers
Note 5. ~~For mixed box height stowage, the weight is to be reduced as follows:~~ $\cancel{W_h = W_h \frac{2.438}{c_a}}$ ~~Where:~~ ~~c_a is the average height of the 20 ft containers~~ Where the homogeneous container weight (W_h) derived from the table is lower than the rated weight of the container, the maximum homogeneous weight is to be corrected to account for the height of the containers used, as follows: $W_{hc} = W_h w_{ac}$ Where: $w_{ac} = \frac{2.591}{c_a}$ which is not to be taken greater than 1 c_a is the average height of the 20 ft containers						

■ *Section 8*

Determination of forces for container securing arrangements

8.2 Ship motion, wind and green sea forces acting on containers

8.2.8 A container is considered protected from wind in the transverse direction or from green sea loads in the longitudinal or transverse direction if an effective breakwater or similar extends above mid height of the container.

Part 4, Chapter 2
Ferries, Roll On-Roll Off Ships and Passenger Ships

■ *Section 4*

Shell envelope plating

4.2 Bow flare and wave impact pressures

4.2.1 This Section is applicable to:
(a) bow flare region
(b) sides and undersides of sponsons; and
(c) other parts of the side shell plating close to and above the design waterline that are expected to be subjected to wave impact pressures

The wave impact pressure, P_{bf}, in kN/m^2 due to relative motion is to be taken as:

~~$= P_{bf} = 0,5(K_{bf}V_{bf2} + K_{rv}H_{rv}V_{rv2})$ kN/m2~~ $P_{bf} = 0,5(K_{bf}V_{bf}^2 + K_{rv}H_{rv}V_{rv}^2)$ kN/m^2

The relative vertical motion, H_{rm}, is to be taken as:

$$\cancel{H_{rm} = C_{w,min}\left(1+\frac{4,5}{(C_b+0,2)}\left(\frac{X_{wL}}{L_{wL}}\right)2\right)} \qquad H_{rm} = C_{w,min}\left(1+\frac{4,5}{(C_b+0,2)}\left(\frac{X_{wL}}{L_{wL}}\right)^2\right)$$

where

$$\cancel{C_{w,min} = \frac{C_w}{\sqrt{2k_m}}} \qquad C_{w,min} = \frac{C_w}{k_m\sqrt{2}}$$

Part 4, Chapter 8
Container Ships

■ *Section 16*
Longitudinal strength calculations

16.9 Hull girder stresses

16.9.2 The hull girder shear stresses, τ_G, in N/mm^2 are to be determined for the section under consideration for the load cases given in *Table 8.16.3 Combination of still water and wave bending moments and shear forces* for all structural elements which contribute to the shear strength capability of the ship.

Where:
Q_w and Q_s are defined in *Table 8.16.3 Combination of still water and wave bending moments and shear forces.*
γ_s, γ_w are partial safety factors to be taken as:

γ_s = 1,0

γ_w = 1,0

- q_v is calculated in accordance with the *ShipRight Procedure ~~Additional calculations for container ships~~ Additional calculation procedures for longitudinal strength*

16.10 Buckling strength assessment

16.10.4 Failure state limits are defined in *ShipRight Procedure ~~Additional calculations for container ships~~ Additional calculation procedures for longitudinal strength* for the following items:

16.10.5 The stress multiplication factor at failure, γ_c, of a structural member is to be determined for any combination of longitudinal and shear stress, *see Figure 8.16.5 Example of failure state limit curve and stress multiplication factor at failure*.
Where:

- σ_c τ_c is the critical buckling stress obtained in accordance with the *ShipRight Procedure ~~Additional calculations for container ships~~ Additional calculation procedures for longitudinal strength* for the stress combination for buckling σ and τ

16.11 Hull girder ultimate strength

16.11.6 The hull girder ultimate bending capacity, *M*U, is to be calculated using the incremental-iterative method as given in *Chapter 4 of ShipRight Procedure ~~Additional calculations for container ships~~ Additional calculation procedures for longitudinal strength*.

Part 4, Chapter 12
Dredging and Reclamation Craft

■ *Section 1*
General

1.3 Class notations

1.3.2 The class notations will be assigned to ships based on the following:

(b) Where dredger types listed in *Pt 4, Ch 12, 1.3 Class notations 1.3.1(a)*, *Pt 4, Ch 12, 1.3 Class notations 1.3.1.(b)* and *Pt 4, Ch 12, 1.3 Class notations 1.3.1.(c)* perform dredging operations at reduced freeboards, resulting in a dredging draught (T_m) greater than the summer draught and without a dredging service area restriction, the class notation will be extended as follows: **'dredging draught T_m of … metres in sea states with H_s <... metres'** and will be subject to special requirements of National Authorities, *see Pt 4, Ch 12, 1.6 Requirements for dredgers operating at reduced freeboards ~~1.6.1~~*.

(c) Where dredger types listed in *Pt 4, Ch 12, 1.3 Class notations 1.3.1(a)*, *Pt 4, Ch 12, 1.3 Class notations 1.3.1.(b)* and *Pt 4, Ch 12, 1.3 Class notations 1.3.1.(c)* perform dredging operations at reduced freeboards, resulting in a dredging draught (T_m) greater than the summer draught but with a dredging service area limited to within 21 nautical miles from shore, the class notation will be extended as follows: **'dredging within 21 miles from shore at a dredging draught T_m of … metres'** and will be subject to special requirements of National Authorities, *see Pt 4, Ch 12, 1.6 Requirements for dredgers operating at reduced freeboards 1.6.1* and *Pt 4, Ch 12, 1.6 Requirements for dredgers operating at reduced freeboards 1.6.2*.

■ *Section 3*
Design

3.1 Intermediate shafts

3.1.1 The diameter, *d*, of the intermediate shaft is to be not less than determined by the following formula:

$$d = Fk \sqrt[3]{\frac{P}{R}\left(\frac{560}{\sigma_u + 160}\right)} \text{ mm}$$

$$\cancel{\left(d = Fk \sqrt[3]{\frac{H}{R}\left(\frac{57}{\sigma_u + 16}\right)} \text{ mm}\right)}$$

where

K = 1,0 for shafts with integral coupling flanges complying with ~~3.7~~ *Pt 5, Ch 6, 3.7 Couplings and transitions of diameters* or with shrink fit couplings, *see Pt 5, Ch 6, 3.1 Intermediate shafts 3.1.4*
F = 95~~(86)~~ for turbine installations, electric propulsion installations and engine installations with ship type couplings
= 100 ~~(90,5)~~ for other engines

P(~~*H*~~) and *R* are defined in *Pt 5, Ch 1, 3.3 Power ratings* (losses in gearboxes and bearings are to be disregarded)

σ_u = specified minimum tensile strength of the shaft material, in N/mm^2 ~~(kgf/mm^2)~~, *see Pt 5, Ch 6, 2.1 Materials for shafts 2.1.3*.

3.2 Gear quill shafts

3.2.1 The diameter of the quill shaft is to be not less than given by the following formula:

Diameter of quill shaft = $101 \sqrt[3]{\frac{P400}{R\sigma_u}}$ mm

$$\cancel{\left(91 \sqrt[3]{\frac{H41}{R\sigma_u}} \text{ mm}\right)}$$

where
P(~~*H*~~) and *R* are as defined in *Pt 5, Ch 1, 3.3 Power ratings*.

σ_u = specified minimum tensile strength of the material, in N/mm^2 ~~(kgf/mm^2)~~ but is not to exceed 1100 N/mm^2 ~~(112 kgf/mm^2)~~.

3.3 Final gear wheel shafts

3.3.3 In both *Pt 5, Ch 6, 3.3 Final gear wheel shafts 3.3.1* and *Pt 5, Ch 6, 3.3 Final gear wheel shafts 3.3.2*, abaft the journals, the shaft may be gradually tapered down to the diameter required for an intermediate shaft determined according to ~~3.1~~ *Pt 5, Ch 6, 3.1 Intermediate shafts*, where σ_u is to be taken as the specified minimum tensile strength of the final wheel shaft material, in N/mm^2 ~~(kgf/mm^2)~~.

3.4 Thrust shafts

3.4.1 The diameter at the collars of the thrust shaft transmitting torque, or in way of the axial bearing where a roller bearing is used as a thrust bearing, is to be not less than that required for the intermediate shaft in accordance with ~~3.1~~ *Pt 5, Ch 6, 3.1 Intermediate shafts* with a *k* value of 1,10. Outside a length equal to the thrust shaft diameter from the collars, the diameter may be tapered down to that required for the intermediate shaft with a *k* value of 1,0. For the purpose of the foregoing calculations, σ_u is to be taken as the minimum tensile strength of the thrust shaft material, in N/mm^2 ~~(kgf/mm^2)~~.

3.5 Screwshafts and tube shafts

3.5.1 The diameter, d_p of the screwshaft immediately forward of the forward face of the propeller boss or, if applicable, the forward face of the screwshaft flange, is to be not less than determined by the following formula:

$$d_p = 100k \sqrt[3]{\frac{P}{R}\left(\frac{560}{\sigma_u + 16}\right)} \text{ mm}$$

$$\cancel{\left(d_p = 90{,}5k \sqrt[3]{\frac{P}{R}\left(\frac{57}{\sigma_u + 16}\right)} \text{ mm}\right)}$$

P(~~*H*~~) and *R* are defined in *Pt 5, Ch 1, 3.3 Power ratings*, (losses in gearboxes and bearings are to be disregarded)

σ_u = specified minimum tensile strength of the shaft material, in N/mm^2 ~~(kgf/mm^2)~~ but is not to be taken as greater than 600 N/mm^2 ~~(61 kgf/mm^2)~~. *See Pt 5, Ch 6, 2.1 Materials for shafts 2.1.3*

3.5.6 For shafts of non-corrosion-resistant materials which are exposed to sea-water, the diameter of the shaft is to be determined in accordance with the formula in *Pt 5, Ch 6, 3.5 Screwshafts and tube shafts 3.5.1* with a *k* value of 1,26 and σ_u taken as 400 N/mm^2 ~~(41 kgf/mm^2)~~.

3.8 Coupling bolts

3.8.1 Close tolerance fitted bolts transmitting shear are to have a diameter, at the joining faces of the couplings not less than given by the following formula:

Diameter of coupling bolts = $\sqrt{\frac{240}{nD}\frac{10_6}{\sigma_u}\frac{P}{R}}$ mm

where
P~~(*H*)~~ and *R* are defined in *Pt 5, Ch 1, 3.3 Power ratings*

3.8.4 The minimum diameter of tap bolts or of bolts in clearance holes at the joining faces of coupling flanges, pretensioned to 70 per cent of the bolt material yield strength value, is not to be less than:

$d_R = 1{,}348\sqrt{\left(\frac{12010_6 F P(1+C)}{RD}+Q\right)\frac{1}{n\sigma_y}}$

where d_R is take as the lesser of:

P~~(*H*)~~ and *R* are defined in *Pt 5, Ch 1, 3.3 Power ratings*

3.9 Bronze or gunmetal liners on shafts

3.9.6 Each continuous liner or length of liner is to be tested by hydraulic pressure to 2,0 bar ~~(2,0 kgf/cm^2)~~ after rough machining.

3.10 Keys and keyways

3.10.4 The effective sectional area of the key in shear, is to be not less than $\frac{d_3}{2{,}6d_1}$ mm^2

where
d = diameter, in mm, required for the intermediate shaft determined in accordance with ~~3.1~~ *Pt 5, Ch 6, 3.1 Intermediate shafts*, based on material having a specified minimum tensile strength of 400 N/mm^2 ~~(41 kgf/mm^2)~~ and *k*=1

3.12 Sternbushes

3.12.1 The length of the bearing in the sternbush next to and supporting the propeller is to be as follows:
(b) For water lubricated bearings lined with two or more circumferentially spaced sectors of an approved plastics material, in which it can be shown that the sectors operate on hydrodynamic principles, the length of the bearing is to be such that the nominal bearing pressure will not exceed 5,5 bar ~~(5,6 kgf/cm^2)~~. The length of the bearing is to be not less than twice its diameter.
(d) For bearings which are white-metal lined, oil lubricated and provided with an approved type of oil sealing gland, the length of the bearing is to be approximately twice the diameter required for the screwshaft and is to be such that the nominal bearing pressure will not exceed 8,0 bar ~~(8,1 kgf/cm^2)~~. The length of the bearing is to be not less than 1,5 times its diameter.

Part 5, Chapter 8
Shaft Vibration and Alignment

■ *Section 2* Torsional vibration

2.5 Limiting stress in propulsion shafting

2.5.3 In no part of the propulsion shafting system may the alternating torsional vibration stresses exceed the values of τ_c for continuous operation, and τ_t for transient running, given by the following formulae:

~~For r <0,9:~~

$\cancel{\tau_c = \frac{\sigma_u+160}{18} C_k C_d (3 - 2r2) N/mm2}$

~~and where r < 0,8~~

$\cancel{\tau_t = \pm 1{,}7\tau_c \frac{1}{\sqrt{C_k}} N/mm2}$

For *r*<0,9:

$\tau_c = \frac{\sigma_u+160}{18} C_k C_d (3 - 2r^2)$ N/mm^2

and where *r* < 0,8

$\tau_t = \pm 1{,}7\tau_c \frac{1}{\sqrt{C_k}}$ N/mm^2

~~For 0,9 ≤ r ≤ 1,05:~~

~~$\tau_c = \frac{\sigma_u + 160}{18} C_k C_d 1{,}38$ N/mm2~~

For 0,9 ≤ r ≤ 1,05:

$\tau_c = \frac{\sigma_u + 160}{18} C_k C_d 1{,}38$ N/mm^2

Part 5, Chapter 12
Piping Design Requirements

■ *Section 1*
General

1.7 Materials

Table 12.1.2 Maximum conditions for pipes, valves and fittings for which manufacturer's materials test certificate is acceptable

Material	*DN* = nominal diameter, mm P_w = working pressure, ~~bar~~ MPa
When the working temperature is less than 300°C: Carbon and low alloy steel, austenitic steel and cast iron (spheroidal or nodular)	*DN* < 50 or P_w x *DN* < 250~~0~~
Copper alloy intended for a working temperature of less than 200°C	*DN* < 50 or P_w x *DN* < 150~~0~~

Part 5, Chapter 14
Machinery Piping Systems

■ *Section 4*
Fuel oil pumps, pipes, fittings, tanks, etc.

4.17 Separate fuel oil tanks

4.17.6 On completion, the tanks are to be tested by a head of water equal to the maximum to which the tanks may be subjected, but not less than ~~2,5~~ 2,4 m above the crown of the tank. Testing is to be carried out in accordance with the requirements of *Pt 3, Ch 9, 9 Procedures for testing tanks and tight boundaries*.

■ *Section 8*
Lubricating oil systems

8.14 Separate oil tanks

8.14.1 On completion, the tanks are to be tested by a head of water equal to the maximum to which the tanks may be subjected~~.~~, but not less than 2,4 m above the crown of the tank. Testing is to be carried out in accordance with the requirements of *Pt 3, Ch 9, 9 Procedures for testing tanks and tight boundaries*.

■ *Section 9*
Hydraulic systems

9.6 Separate oil tanks

9.6.1 On completion, the tanks are to be tested by a head of water equal to the maximum to which the tanks may be subjected, but not less than 2,4 m above the crown of the tank. Testing is to be carried out in accordance with the requirements of *Pt 3, Ch 9, 9 Procedures for testing tanks and tight boundaries*.

Part 5, Chapter 24
Emissions Abatement Plant for Combustion Machinery

■ *Section 7* **Pumping and piping**

7.1 General

7.1.9 Where scrubbers are used, the following apply:

(a) Closed loop wet scrubbers are to have natural gravity fall drainage from the wet sump of the scrubber to the process tank or circulating pump suction, with the drain line dimensioned to accommodate 125 per cent of the maximum pumping capacity of the installed water pump(s). No valves are to be fitted to the drain line from the scrubber sump to the process tank unless it can be demonstrated that suitable precautions are in place to prevent the possibility of the scrubber filling with water and reverse-flowing into the engine exhaust duct. Where a valve is fitted to this line, the system is to be protected as for the overboard discharge valve of an open loop system, in accordance with ~~*Pt 5, Ch 24, 9.1 General 9.1.9*~~ *Pt 5, Ch 24, 9.1 General 9.1.8*.

(b) For open loop wet scrubbers, the overboard discharge valve and any other sea-water valves downstream of the scrubber are to be protected in accordance with ~~*Pt 5, Ch 24, 9.1 General 9.1.9*~~ *Pt 5, Ch 24, 9.1 General 9.1.8*. The sea suction valve(s) are also to have position indicators which are to give remote indication of valve position. The scrubber is to be mounted above the waterline under all operating conditions to prevent seawater ingress into the scrubber from the natural flow.

Part 6, Chapter 2
Electrical Engineering

■ *Section 1* **General requirements**

1.1 General

1.1.7 Lloyd's Register (hereinafter referred to as 'LR') will be prepared to give consideration to special cases or to arrangements which are equivalent to the Rules. For unconventional designs, *see also* ~~*Pt 7, Ch 15 Refrigeration Systems and Equipment Serving Provision Stores and Air-Conditioning Installations*~~ *Pt 7, Ch 14 Requirements for Machinery and Engineering Systems of Unconventional Design*. Consideration will also be given to electrical arrangements of small ships and ships to be assigned class notation for restricted or special services.

1.2 Documentation required for design review

1.2.1 The documentation described in *Pt 6, Ch 2, 1.2 Documentation required for design review 1.2.2* to *Pt 6, Ch 2, 1.2 Documentation required for design review* ~~*1.2.15*~~ *1.2.16* is to be submitted for design review.

■ *Section 3* **Emergency source of electrical power**

3.2 Emergency source of electrical power in all ships

3.2.2 Where compliance with *Pt 6, Ch 2, 3.2 Emergency source of electrical power in all ship types 3.2.1* is not practicable, details of the proposed design and arrangements are to be submitted for consideration in accordance with ~~SOLAS II-1, Part D, *Regulation 45 - Precautions against shock, fire and other hazards of electrical origin (Paragraphs 10 and 11 of this regulation apply to ships constructed on or after 1 January 2007)*~~ SOLAS II-1, Part F, *Regulation 55 Alternative design and arrangements*.

3.3 Emergency source of electrical power in passenger ships

3.3.3 Where compliance with *Pt 6, Ch 2, 3.3 Emergency source of electrical power in passenger ships 3.3.1* and P*t 6, Ch 2, 3.3 Emergency source of electrical power in passenger ships 3.3.2* is not practicable, details of the proposed design and arrangements are to be submitted for consideration in accordance with ~~SOLAS II-1, Part D, *Regulation 45 - Precautions against shock, fire and other hazards of electrical origin (Paragraphs 10 and 11 of this regulation apply to ships constructed on or after 1 January 2007)*~~ SOLAS II-1, Part F, *Regulation 55 Alternative design and arrangements*.

3.4 Emergency source of electrical power in cargo ships

3.4.2 Where compliance with *Pt 6, Ch 2, 3.4 Emergency source of electrical power in cargo ships 3.4.1* is not practicable, details of the proposed design and arrangements are to be submitted for consideration in accordance with ~~SOLAS II-1, Part D, *Regulation 45 - Precautions against shock, fire and other hazards of electrical origin (Paragraphs 10 and 11 of this regulation apply to ships constructed on or after 1 January 2007)*~~ SOLAS II-1, Part F, *Regulation 55 Alternative design and arrangements*.

■ *Section 14*
Electrical equipment for use in explosive gas atmospheres or in the presence of combustible dusts

14.9 Cable and cable installation

14.9.2 In addition to the requirements of *Pt 6, Ch 2, 11 Electric cables, optical fibre cables and busbar trunking systems (busways)*, cables for circuits that are not intrinsically safe, which are located in hazardous areas, or which may be exposed to cargo oil, oil vapour or gas, are to be either:

(a) armoured or braided for earth detection, or
(b) otherwise adequately protected against mechanical or chemical damage, within **zone 2** or non-hazardous locations only, or
(c) as otherwise specifically permitted elsewhere within this Section~~.~~, or
(d) mineral insulated with copper sheath.

■ *Section 18*
Crew and passenger emergency safety systems

18.2 General emergency alarm system

18.2.3 In conjunction with the *IMO Code on Alerts and Indicators, 2009 4 General* the general emergency alarm distribution system is to be so arranged that a fire or casualty in any one main vertical zone, as defined by SOLAS ~~1974 as amended Reg~~ Chapter II-2~~/~~, Part A, Regulation 3 - Definitions, other than the zone in which the public address control station is located, will not interfere with the distribution in any other such zone.

18.3 Public address system

18.3.1 Public address systems on passenger ships and cargo ships used to sound the general emergency alarm or the fire-alarm are to comply with SOLAS Ch III, Part B, Regulation 6, *Sections 4* and *5*, the LSA Code - International Life-Saving Appliance Code – Resolution MSC.48(66) ,*Code on Alerts and Indicators, 2009* , and the requirements of this Section.

Part 7, Chapter 11
Arrangements and Equipment for Environmental Protection (ECO Class Notation)

■ *Section 2*
Minimum requirements

2.3 Sulphur oxides (SOx)

2.3.6 Alternative arrangements providing an equivalent level of environmental protection will be considered. If an exhaust gas cleaning system is fitted, it is to be certified to ~~*Resolution MEPC.184(59) – 2009 Guidelines for Exhaust Gas Cleaning Systems – (adopted on 17 July 2009)*~~ *Resolution MEPC.259(68) – 2015 Guidelines for Exhaust Gas Cleaning Systems – (Adopted on 15 May 2015)*.

■ *Section 3*
Supplementary characters

3.1 Hull anti-fouling systems – A character

3.1.1 For assignment of the **A** character, the anti-fouling system applied to the ship's hull is to be listed as biocide-free in the *Lloyd's Register* List of ~~Approved Products~~ *Approved Anti-corrosion and Antifouling Coating Systems*.

3.16 Sulphur oxides – DIST and SOx characters

3.16.4 Alternative arrangements providing an equivalent level of environmental protection will be considered for the assignment of the **SOx** character. If an Exhaust Gas Cleaning System is fitted, it is to be certified to ~~*Resolution MEPC.184(59) – 2009 Guidelines for Exhaust Gas Cleaning Systems – (adopted on 17 July 2009)*~~ *Resolution MEPC.259(68) – 2015 Guidelines for Exhaust Gas Cleaning Systems – (Adopted on 15 May 2015)*.

Part 7, Chapter 12
Passenger and Crew Accommodation Comfort

■ *Section 4* Testing

4.3 Noise measurements

4.3.1 Noise measurements are to be conducted in accordance with ISO 2923 and IMO *Resolution MSC.337(91) – Adoption of the Code on Noise Levels on Board Ships – (Adopted on 30 November 2012)The Annex below is consolidated into Resolution MSC.337(91)*. Measurements of noise levels are to be carried out using precision grade sound level meters conforming to ~~IEC 60672-1~~ IEC 61672-1, Type 1 or 2. Subject to demonstration, equivalent standards are acceptable.

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